

# Computer Vision Applications

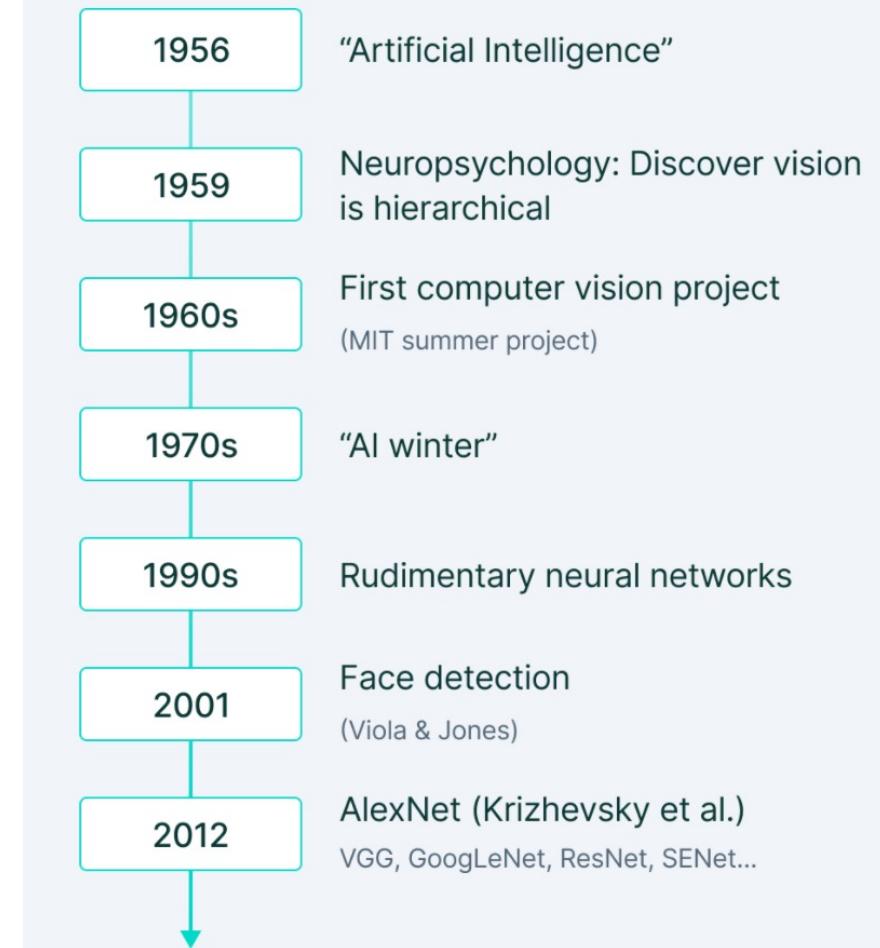
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# What is Computer Vision?

- Computer Vision is a subfield of Deep Learning and Artificial Intelligence where humans teach computers to see and interpret the world around them.
- Computer Vision gives the machines the sense of sight—it allows them to “see” and explore the world thanks to Machine Learning and Deep Learning algorithms.

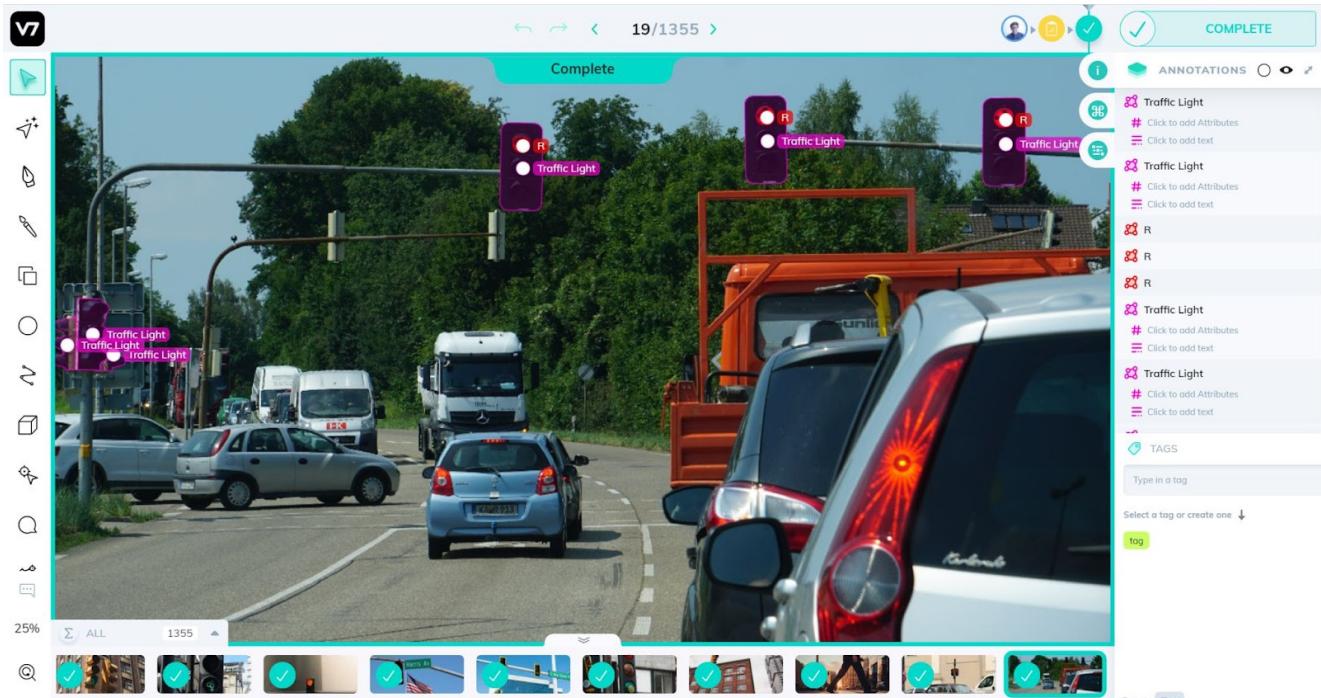
## A brief history of Computer Vision



# Computer Vision Applications

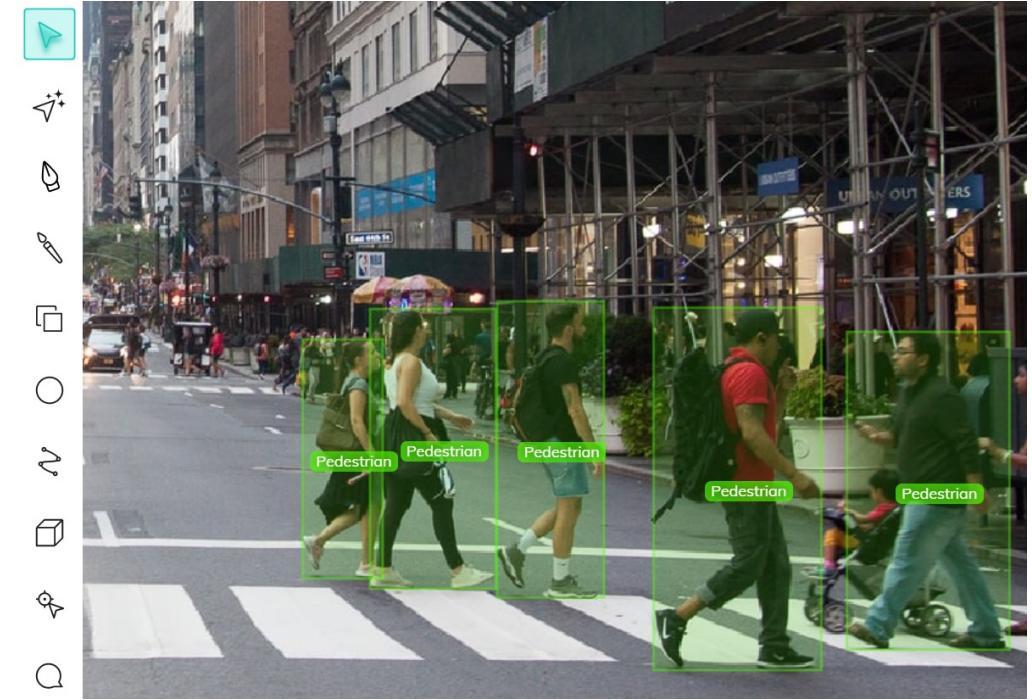
1. Transportation
2. Healthcare
3. Manufacturing
4. Agriculture
5. Retail

# I. Transportation



## Self-driving cars

- Computer vision is used to detect and classify objects (e.g., road signs or traffic lights), create 3D maps or motion estimation, and played a key role in making autonomous vehicles a reality.
- Self-driving cars collect data on their surroundings from sensors and cameras, interpret it, and respond accordingly.



## Pedestrian detection

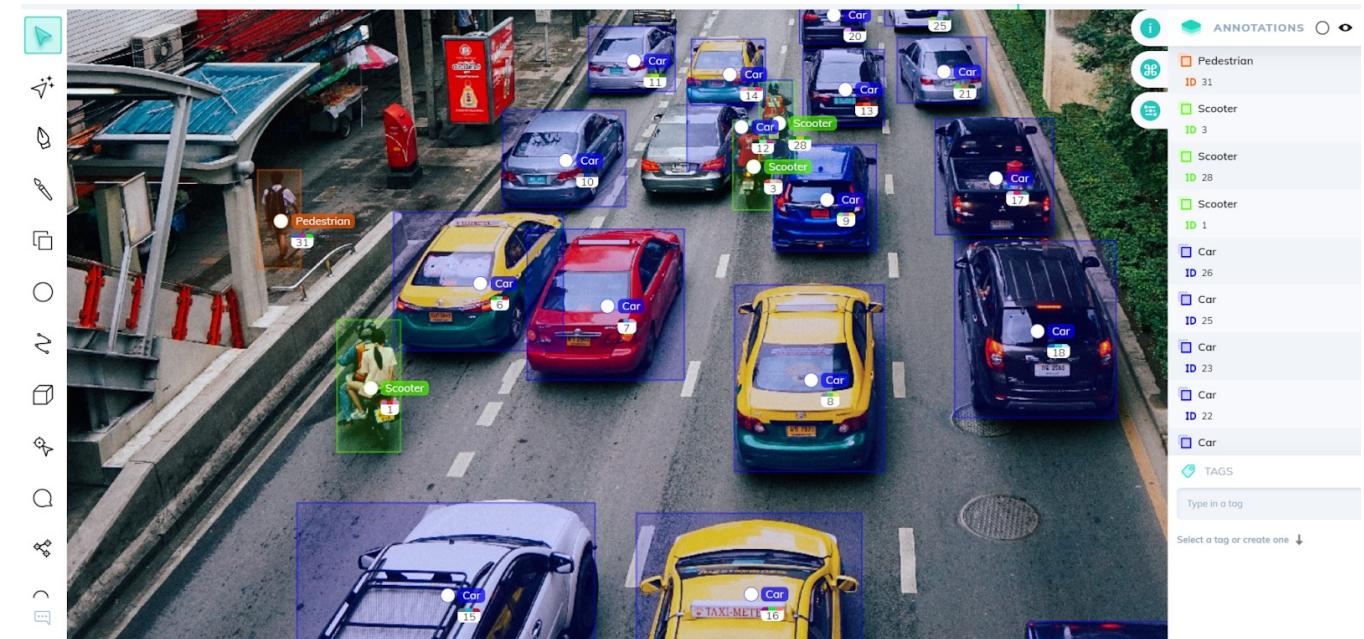
- It uses cameras to automatically identify and locate the pedestrians in images or videos while considering variations related to body attire and position, occlusion, illuminance in different scenarios, and background clutter.
- autonomous driving, traffic management, and transit safety and efficiency.

# I. Transportation



## Parking Occupancy detection

- Thanks to CNNs, camera-based parking occupancy detection systems have quickly achieved extremely high accuracy, almost unsusceptible to changes in illuminance and weather conditions.



## Traffic flow analysis

- The algorithms can now accurately track and count freeway traffic or monitor and analyze traffic density in urban areas (e.g., at intersections), helping to design better traffic management systems and improve road safety.

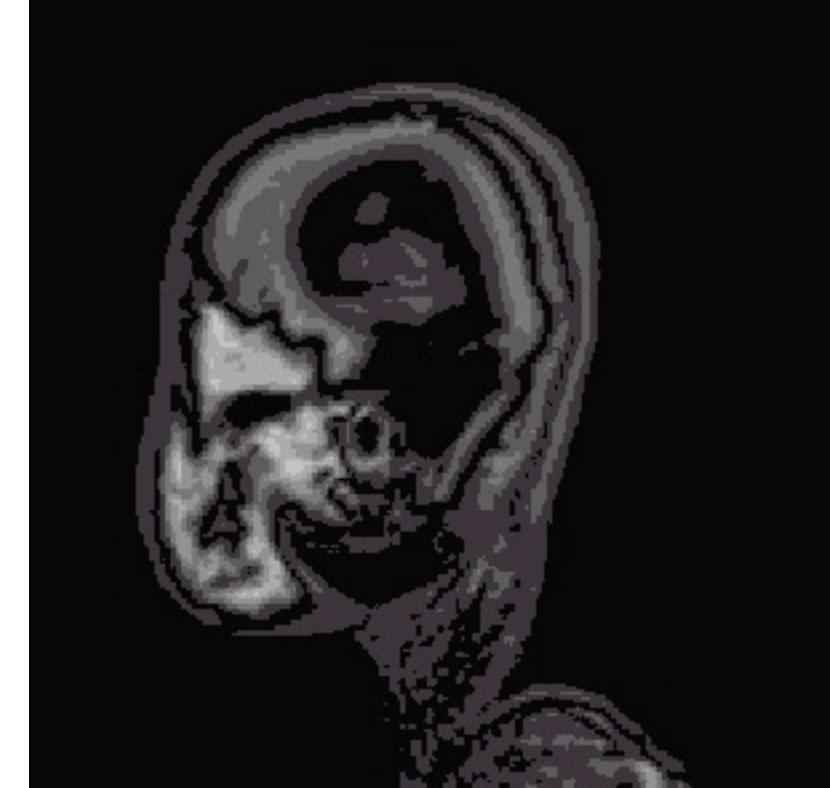
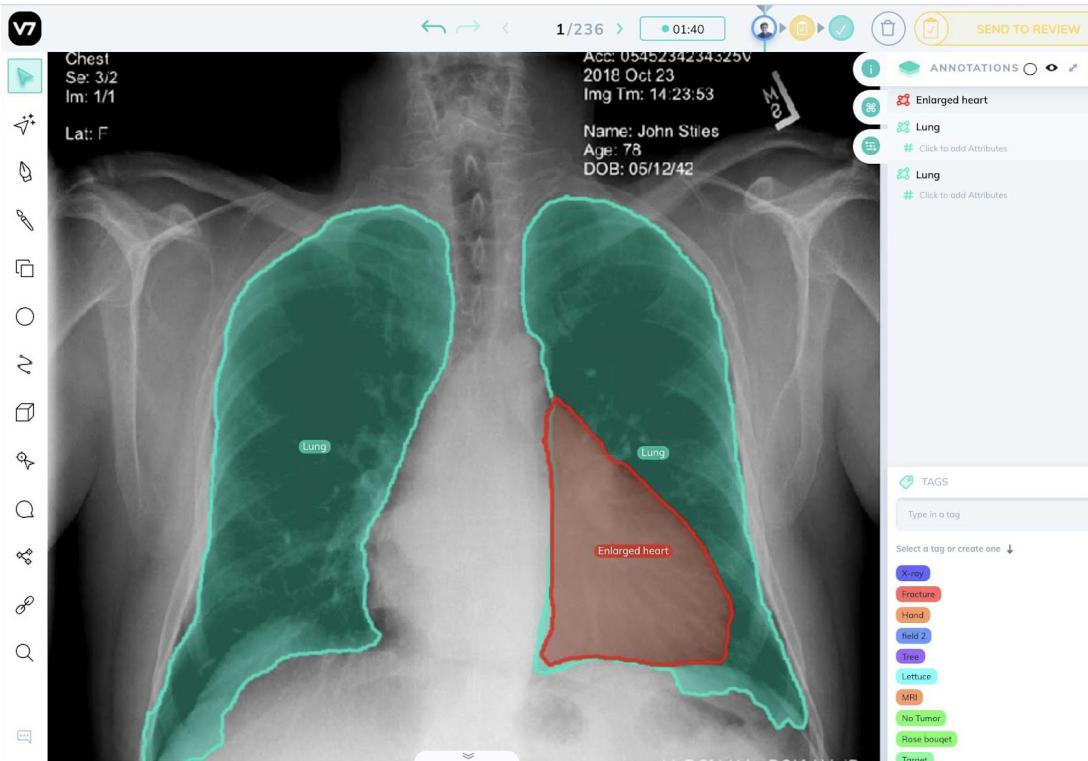
# I. Transportation

## Road Condition Monitoring

- Computer vision has also been successfully used for defect detection and found application in assessing the infrastructure condition by monitoring changes in concrete and asphalt.



# 2. Healthcare



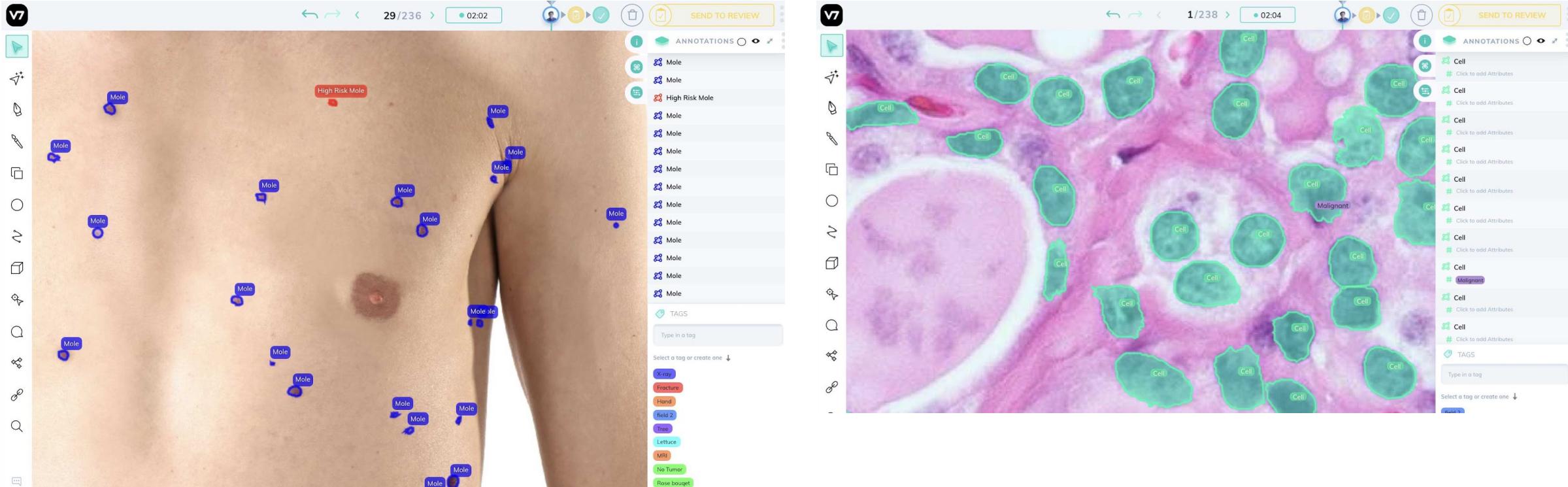
## X-Ray Analysis

- Although most doctors are still relying on the manual analysis of X-ray images for diagnosing and treating diseases, computer vision can automate the process, increasing both efficiency and accuracy.

## CT and MRI

- Using computer vision to analyze CT and MRI scans can help doctors to detect tumors, internal bleeding, clogged blood vessels, and other life-threatening conditions.

# 2. Healthcare



## Cancer Detection

- Image recognition allows doctors to identify anomalies and changes by comparing cancerous and non-cancerous cells in images.

## Digital Pathology

- Image analysis and interpretation
- Detailed inspections of sample tissues
- Pathology types matching to earlier cases
- Diagnosis accuracy and early detection

# 3. Manufacturing



## Defect Inspection

- Camera-based systems can collect real-time data and leverage computer vision and machine learning algorithms to analyze it and benchmark the results against a predefined set of quality standards.
- This facilitates the error-free production process and decreases costs.



## Reading text and barcodes

- As most products have barcodes on their packaging, a computer vision technique called OCR(Optical Character Recognition) can be successfully applied to automatically detect, verify, convert and translate barcodes into readable text.

# 4. Agriculture



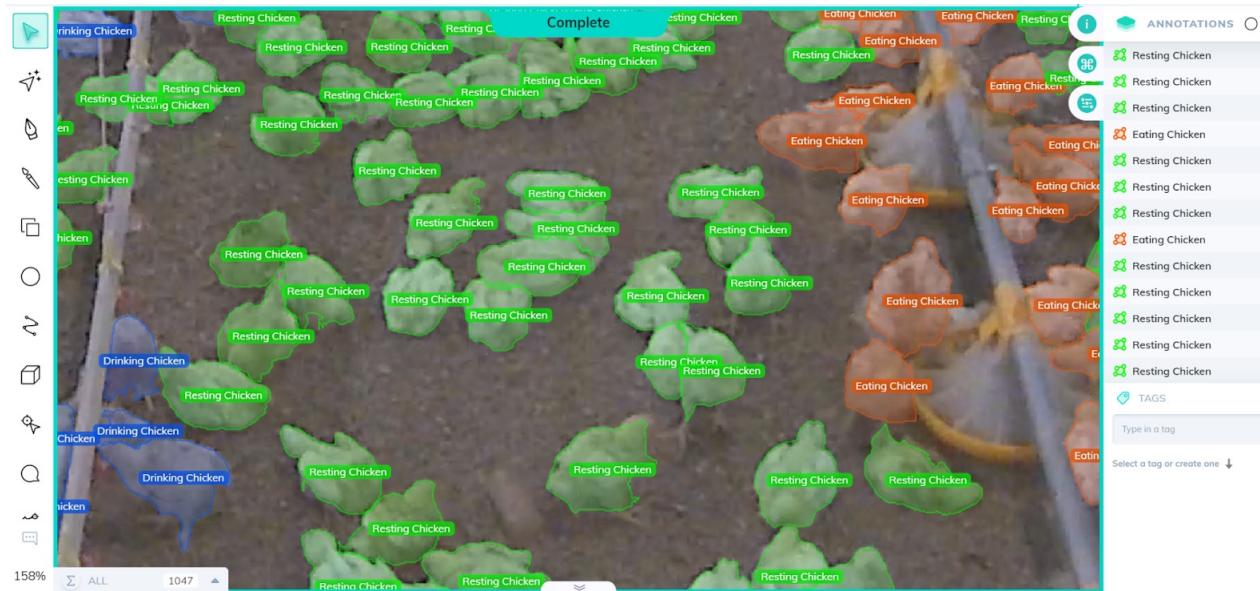
## Crop and Yield Monitoring

- Traditionally, crop growth monitoring relies on subjective human judgment and is neither timely nor accurate.
- Computer Vision allows for continuous real-time monitoring of plant growth and detection of changes in crops due to malnutrition or disease.

## Insect Detection

- Camera-based crop monitoring systems can recognize, classify and count insects threatening the crops.
- Automated insect pest control is cost-effective and helps reducing pesticide use.

# 4. Agriculture



## Livestock Health Monitoring

- Computer vision systems help monitor animals and their actions remotely and in real-time.
- It is especially helpful for animal counting, detecting disease or unusual behavior, or monitoring giving birth.

## Plant Disease Detection

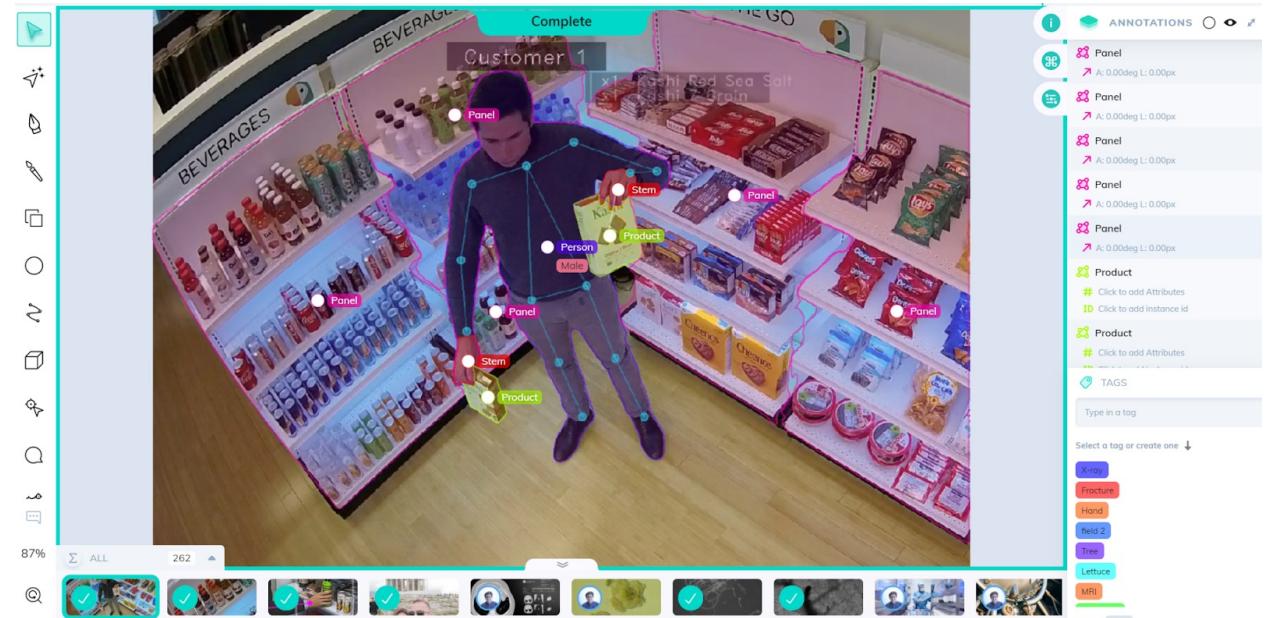
- Computer vision is also widely used for the automated detection of plant diseases, especially crucial at an early stage of plant growth.
- Deep learning-based algorithms use image data to identify the diseases, estimate their severity and impact on yield predictions.

# 5. Retail



## Automatic Replenishment

- Computer vision systems can also capture image data and perform a full inventory scan by tracking items on shelves at intervals of a few milliseconds.
- The system can provide instant notifications on stock-outs and sales and help staff with inventory management.



## Intelligent Video Analytics

- Computer vision-based systems for theft detection have proven to be more accurate as they allow for real-time analysis of the movement.
- AI-powered cameras can also be used to detect other kinds of behaviors like physical assaults or accidents, thus improving safety.

# References

- <https://www.v7labs.com/blog/what-is-computer-vision>
- <https://www.v7labs.com/blog/computer-vision-applications>
- <https://www.youtube.com/watch?v=oGvHtpJMO3M>
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Thank You